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Haem iron and nitrate/nitrite account for much of the mortality increase associated with red meat consumption

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DOI: <https://doi.org/10.1136/ebmed-2017-110787>

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ZORA URL: <https://doi.org/10.5167/uzh-145365>

Journal Article

Accepted Version

Originally published at:

Rohrmann, Sabine; Linseisen, Jakob (2017). Haem iron and nitrate/nitrite account for much of the mortality increase associated with red meat consumption. Evidence-based medicine, 22(5):179.

DOI: <https://doi.org/10.1136/ebmed-2017-110787>

Category: Aetiology/ Harm

Study type: Cohort study

Authors' declarative title: Heme iron and nitrate/nitrite account for much of the mortality-increase associated with red meat consumption

Citation: Etemadi, A, Sinha R, Ward MH, et al. Mortality from different causes associated with meat, heme iron, nitrates, and nitrites in the NIH-AARP Diet and Health Study: population based cohort study

Context

The International Agency for Research on Cancer categorized processed meat as carcinogenic to humans in 2015.¹ High red and processed meat consumption is positively associated with risk of cardiovascular disease and type-2 diabetes as well as overall mortality.² Usually the intake of processed red meat is found to be more strongly associated with disease outcomes than unprocessed red meat, which is thought to be due to preservation methods such as salting, curing and smoking, increasing the concentration of potentially hazardous substances in meat.³

Methods

In the US NIH-AARP diet and health study, more than half a million participants were recruited in 1995 (51-70 years old). Diet was assessed using a 124-item food frequency questionnaire (FFQ) that covered habitual diet of the previous 12 months. Intake of heme iron, nitrate, and nitrite was calculated from information on meat type. Confounders were assessed by questionnaire and mortality information by annual linkage with the Social Security Administration and the National Death Index. Among 536,969 participants, 128,524 deaths were registered until the end of follow-up in December 2011.

Findings

High consumption of unprocessed and processed red meat was positively associated with all-cause and cause-specific mortality. Intakes of heme iron and nitrate/nitrite were also associated with mortality. Using mediation models, 20.8% of the association between unprocessed red meat intake and all-cause mortality was accounted for by heme iron (14.3% for CVD and 32.7% for cancer mortality). Although heme iron also accounted for 21.3% of the effects of processed red meat on total mortality, nitrate explained a large proportion of the effects of processed red meat on mortality (50.1% for total, 72.0% for CVD and 73.0% for cancer mortality). Substitution by unprocessed white meat was associated with reduced mortality.

Commentary

This study is an extension of previously published results of the NIH-AARP cohort on meat consumption and mortality, which already reported a positive association of red and processed meat consumption with overall, CVD and cancer mortality.⁴ The present analysis, which adds almost twice as many deaths, reported for most causes of deaths a positive association with unprocessed and processed meat consumption. Using different types of statistical models, the authors show that heme iron and nitrate/nitrite account for a large proportion of the associations between processed and unprocessed red meat and mortality. The results on nitrate/nitrite in this study support existing cancer prevention recommendations to minimise the consumption of processed red meat.

In a large European cohort study addressing the association between meat intake and mortality, processed but not unprocessed red meat was strongly associated with mortality.⁵ Differences in the types of processed meat consumed, the preparation of unprocessed red

meat, but also differential attribution of foods to either red or processed meat may help to explain the different findings. Interestingly, Asian studies, in which red meat intake is rather low, usually do not observe statistically significant associations between red meat intake and mortality.⁶

The study shows that white meat was, in contrast to red meat, associated with reduced mortality, although it still needs to be determined whether this is true for both unprocessed and processed white meat. To decrease health risks, it is certainly recommendable to reduce red meat in the diet and possibly replace (part of) it with white meat.

Implications for practice

Although we can never exclude that results of epidemiological studies are at least partly due to unmeasured residual confounding, too much red meat, be it processed or unprocessed, appears to be etiologically involved in chronic diseases development. These findings support public health messages to moderate the intake of red meat, minimise the intake of processed red meat and substitute white for red meats.

Competing interests: None.

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